Chapter 15

Source-Specific Multicast

Source-specific multicast (SSM) is a service model that identifies session traffic by both source and group address. SSM implemented in the JUNOS software has the efficient explicit join procedures of Protocol Independent Multicast (PIM) sparse mode but eliminates the immediate shared tree and rendezvous point (RP) procedures using (*, G) pairs. The (*) is a wildcard referring to any source sending to group G, and "G" refers to the IP multicast group. SSM builds shortest-path trees (SPTs) directly represented by (S,G) pairs. The "S" refers to the source's unicast IP address, and the "G" refers to the specific multicast group address. The SSM (S,G) pairs are called channels to differentiate them from any-source multicast (ASM) groups. Although ASM supports both one-to-many and many-to-many communications, ASM's complexity is in its method of source discovery. For example, if you click on a link in a browser, the receiver is notified about the group information, but not the source information. With SSM, the client receives both source and group information.

SSM is ideal for one-to-many multicast services such as network entertainment channels. However, many-to-many multicast services might require ASM.

To deploy SSM successfully, you need an end-to-end multicast-enabled network and applications that use an Internet Group Management Protocol version 3 (IGMPv3) stack. An IGMPv3 stack is the capability of a host operating system to use the IGMPv3 protocol. Most operating systems today use an IGMPv2 stack, but IGMPv3 is available for Windows XP, and upgrades are available on some UNIX operating systems.

For information about standards supported for source-specific multicast, see "IP Multicast Standards" on page 28.

This chapter discusses the following topics:

Source-Specific Multicast Groups Overview

SSM is typically supported with a subset of IGMPv3 and PIM sparse mode known as PIM SSM. Using SSM, a client can receive multicast traffic directly from the source. PIM SSM uses the PIM sparse-mode functionality to create an SPT between the client and the source, but builds the SPT without the help of an RP.

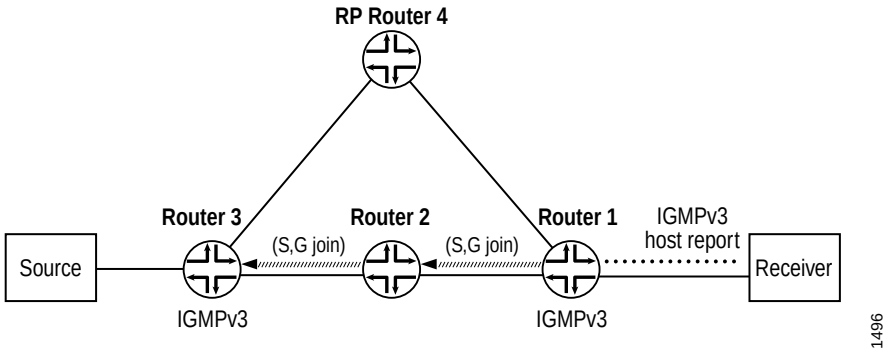
By default, the SSM group multicast address is limited to the IP address range 232.0.0.0 to 232.255.255.255. However, you can extend SSM operations into another Class D range by including the address statement at the [edit routing-options multicast ssm-groups] hierarchy level.

An SSM-configured network has distinct advantages over a traditionally configured PIM sparse-mode network. There is no need for shared trees or RP mapping (no RP is required), or for RP-to-RP source discovery through the Multicast Source Discovery Protocol (MSDP).

Deploying SSM is easy. You need only configure PIM sparse mode on all router interfaces and issue the necessary SSM commands, including specifying IGMPv3 on the receiver's LAN. If PIM sparse mode is not explicitly configured on both the source and group members interfaces, multicast packets are not forwarded. Source lists, supported in IGMPv3, are used in PIM SSM. Only sources that are specified send traffic to the SSM group.

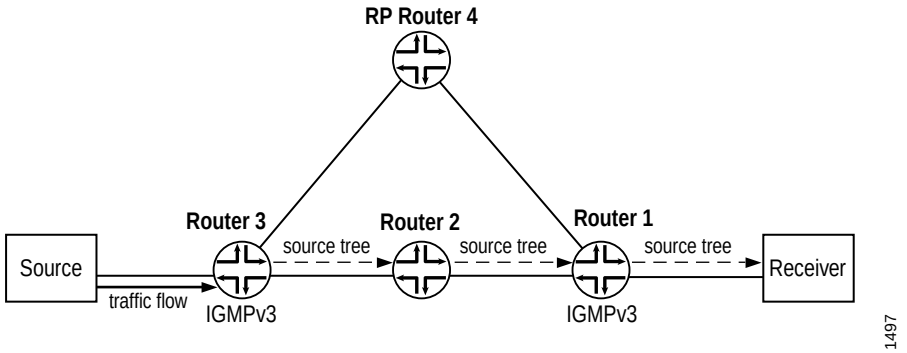
In a PIM SSM-configured network, a host subscribes to an SSM channel (by means of IGMPv3), announcing a desire to join group G and source S (see Figure 10). The directly connected PIM sparse-mode router, the receiver's designated router (DR), sends an (S,G) join message to its reverse-path forwarding (RPF) neighbor for the source. Notice in Figure 10 that the RP is not contacted in this process by the receiver, as would be the case in normal PIM sparse-mode operations.

Figure 10: Receiver Announces Desire to Join Group G and Source S



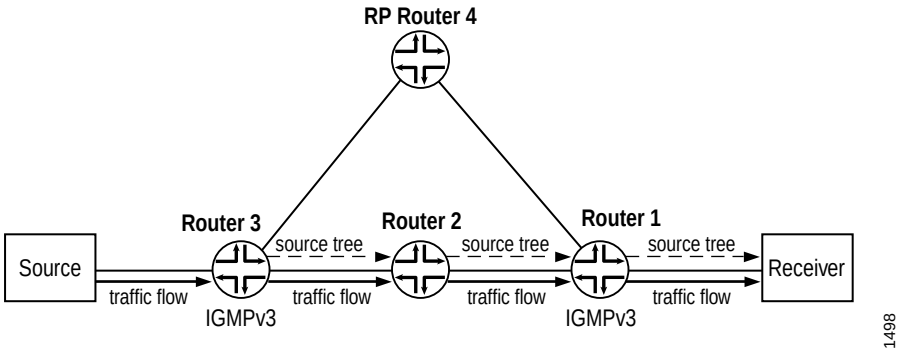
The (S,G) join message initiates the source tree, then builds it out hop by hop until it reaches the source. In Figure 11, the source tree is built across the network to Router 3, the last-hop router connected to the source.

Figure 11: Router 3 (Last-Hop Router) Joins the Source Tree



Using the source tree, multicast traffic is delivered to the subscribing host (see Figure 12).

Figure 12: The (S,G) State Is Built Between the Source and the Receiver



To configure additional SSM groups, include the ssm-groups statement:

```
multicast {
    ssm-groups {
      address;
    }
}
```

For a list of the hierarchy levels at which you can configure this statement, see the statement summary section for this statement.

For an overview of logical routers and a detailed example of logical router configuration, see the logical routers chapter of the *JUNOS Feature Guide*.

Source-Specific Multicast Examples

This section discusses the following topics:

Example: Configuring an SSM-Only Domain

Deploying an SSM-only domain is much simpler than deploying an ASM domain; it only requires a few configuration steps. Enable PIM sparse mode on all interfaces by adding the mode statement at the [edit protocols pim interface all] hierarchy level. When configuring all interfaces, exclude the fxp0.0 management interface by adding the disable statement for that interface. Then configure IGMPv3 on all host-facing interfaces by adding the version statement at the [edit protocols igmp interface *interface-name*] hierarchy level.

In the following example, the host-facing interface is fe-0/1/2:

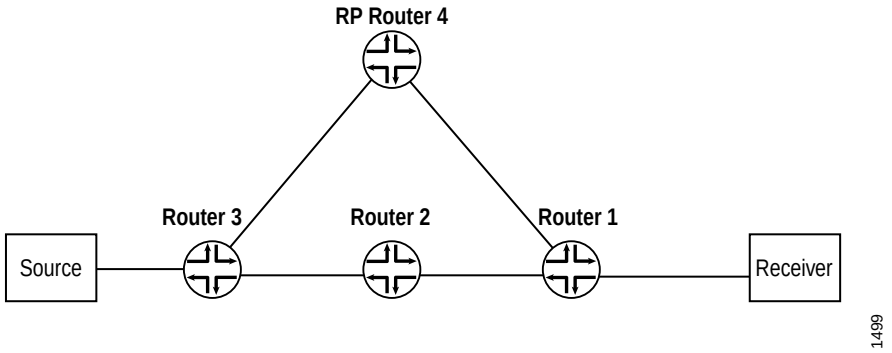
```
[edit]
protocols {
    pim {
        interface all {
            mode sparse;
                version 2;
        }
        interface fxp0.0 {
            disable;
        }
    }

    igmp {
        interface fe-0/1/2 {
            version 3;
        }
    }
}
```

Example: Configuring PIM SSM on a Network

The following example shows how PIM SSM is configured between a receiver and a source in the network illustrated in Figure 13.

Figure 13: Network on Which to Configure PIM SSM



The configuration establishes IGMPv3 on all receiving host interfaces. You then can use the following show commands to verify the PIM SSM configuration:

Issue the show igmp interface command to display IGMP interfaces, configurable parameters, and IGMP version.

Issue the show pim join extensive command to display the PIM state.

This example discusses the following topics that provide information about configuring and verifying operation of PIM SSM:

Enabling IGMPv3 on all Host-Facing Interfaces on page 131

Displaying the IGMP State on page 132

Displaying the PIM State on page 132

Enabling IGMPv3 on all Host-Facing Interfaces

To enable IGMPv3 on all host-facing interfaces, include the version 3 statement under the interface all statement at the [edit protocols igmp] hierarchy level:

```
[edit protocols igmp]
interface all {
    version 3;
}
interface fxp0.0 {
    disable;
}
```

NOTE: When you configure IGMPv3 on a router, hosts on interfaces configured with IGMPv2 cannot join the source tree.

Displaying the IGMP State

To show IGMP information about the interfaces on Router 1, use the show igmp interface command:

```
user@router1> show igmp interface
Interface     State   Querier       Timeout Version Groups
fxp1.0        Up                    0     3     0
fe-0/0/0.0    Up      198.58.3.245  213     3     0
fe-0/0/1.0    Up      198.58.3.241  220     3     0
fe-0/0/2.0    Up      198.58.3.237  218     3     0…

Configured Parameters:
IGMP Query Interval (1/10 secs): 1250
IGMP Query Response Interval (1/10 secs): 100
IGMP Last Member Query Interval (1/10 secs): 10
IGMP Robustness Count: 2

Derived Parameters:
IGMP Membership Timeout (1/10 secs): 2600
IGMP Other Querier Present Timeout (1/10 secs): 2550
```

Displaying the PIM State

To show the PIM state on Router 2 and Router 3 (the upstream routers), use the show pim join extensive command:

```
user@router2> show pim join extensive
232.1.1.1      10.4.1.2                  sparse
    Upstream interface: fe-1/1/3.0
    Upstream State: Local Source
    Keepalive timeout: 209
    Downstream Neighbors:
      Interface: so-1/0/2.0
          10.10.71.1       State: Join   Flags: S    Timeout: 209
```

To show the PIM state on Router 1 (the router connected to the receiver), use the show pim join extensive command:

```
user@router1> show pim join extensive
232.1.1.1      10.4.1.2                  sparse
    Upstream interface: so-1/0/2.0
    Upstream State: Join to Source
    Keepalive timeout: 209
    Downstream Neighbors:
      Interface: fe-0/2/3.0
          10.3.1.1         State: Join   Flags: S    Timeout: Infinity
```